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USSR STANDARD ON METHODS FOR RECLAIMING WASTE LUBRICATING OILS (GOST 1974-43)

(Petroleum Industry B 23)

This standard deals with the methods for regenerating (restoring qualitative indexes) of waste lubricating oils.

I. CLASSIFICATION

1. The following methods for regenerating waste lubricating oils are hereby established:

No 1. Settling and filtration

No 2. Catalysis and filtration

No 3. Alkaline treatment, catalysis and filtration

No 4. Acid treatment, catalysis and filtration

No 5. Acid treatment, alkaline treatment, catalysis and filtration

No 6. Distillation of the fuel content, catalysis and filtration

No 7. Acid treatment, alkaline treatment, distillation of the fuel content, catalysis and filtration

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STATE	X	NAVY	X	NSRB		DISTRIBUTION						
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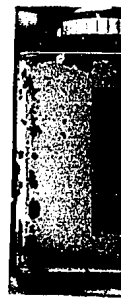

Oil	Standard	Method to Be Used	Remarks
A. Industrial Oils			
1. Vaseline Solar	GOST 1665-42 GOST 1666-42	1	
2. Vaseline MVP	GOST 1805-42	1	
3. Spindle	GOST 1837-42	1;2;4	Methods 2 and 4 apply for reclaiming from circulation systems those industrial oils used in lubrication of hot machine parts and cylinder oil "2" used in compressors
4. Machine	GOST 1707-42	1;2;4	
5. Cylinder "2"	GOST 1841-42	1;2;4	
B. Oils for Internal-Combustion Engines			
1. Aviation	GOST 1013-41, Narkomneft' TU, No 118-42 OST NKPP 466	1;2;6	Method No 1 is used under conditions prevailing both at field airdromes and at aircraft plants
2. Automobile	GOST 1862-42	1;2;6;7	Method No 1 is used under conditions prevailing in field garages. The reclaimed oil must be mixed in the following proportions: 40% reclaimed and 60% fresh
3. Diesel	GOST B-1600-43 (replaced by GOST 1600-46)	1;2;6	
4. Nitrol	GOST 542-41	1	
5. Motor	GOST 1519-42	2;6	Method No 2 is used to reclaim oils which are used in engines run on generator gas. These oils are kept separately
C. Special Lubricating Oils			
1. Turbine	GOST 32-42	2;3;4;5;6	Method No 2 is used for waste oil having an acid number up to 0.25 mg KOH; methods No 3 and No 4 for oils with acid number up to 0.5 mg KOH Method No 6 is used without distilling off the fuel content

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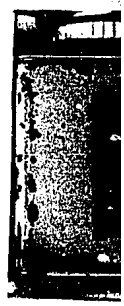

Oil	Standard	Method to Be Used	Remarks
2. Compressor	GOST 1661-42 (replaced by GOST 1861-44)	2;4;6	Method No 6 is used without distilling off the fuel content
3. Ship	GOST 2022-43	1	
4. Axle	GOST 610-42	1	
D. Steam Engine Oils			
1. Viscosine	GOST 1859-42	2;4	
2. "Vapor" (Special cylinder oil for steam engines)	GOST 788-43	2;4	
"Vapor" goudron	GOST B-2031-43		
3. Cylinder	GOST 10001-38 (replaced by GOST 3190-46)		
E. Special Purpose Oils			
1. Transformer	GOST 982-43	2;3;4;5	Method No 2 is used for waste oil having an acid number up to 0.25 mg KOH; methods No 3 and No 4 for oils with an acid number up to 0.5 mg KOH
2. Sulfurized cutting oil	GOST B-122-42		This oil is presulfurized

NOTE: The recovery methods established by this standard do not cover the saponified auto and tractor oils and the distillate from industrial oils.

II. RECOVERY METHODS

3. Preliminary sedimentation of mechanical impurities and water is required in the case of every method used. This is done in a conical-bottom settling tank, heated by steam (Drawing No 1), by electricity (Drawing No 1), or by flame (Drawing No 2), or without heating (Drawing No 1). An oil heater using water as a heating medium can also be used.

Heating accelerates the process considerably.

In heated settling, the oil temperature is maintained between 50 and 90° C. The time of settling, depending on the degree of contamination and the oil temperature, varies from 4 to 48 hr.

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Since one settling operation will not give maximum recovery, the first and the simplest recovery method combines settling and filtration.

4. Method No 1, Settling and Filtration (Drawings 3, 4, and 5)

The waste oil is either pumped or poured into the settling tank, from which (after settling of water and mechanical impurities) it is fed by gravity flow or pump onto a filter or filter-press. The feed-pressure, when using a simple filter, is 0.3 at; when feeding by hand pump to a filter-press, 3-4 at; and by mechanical pump to filter-press, up to 6 at. When the pressure rises to 7-8 at, the filter-press must be stopped, cleaned, and recharged. The filter medium may be paper (filter paper, newspaper, wrapping paper), linen belting, woolen cloth, felt, burlap and wiping materials.

5. Method No 2, Catalysis and Filtration (Drawing No 6)

The waste oil, after settling, is fed into a mixing tank equipped with a hand or mechanical agitator and with a heating system (steam, electric, or flame). Low-viscosity oils are heated to 90-100° C, and high-viscosity oils to 150-180° C. Then 3-10 percent bleaching clay, (previously dried for 2-3 hr at 120-150° C and passed through a 40-mesh screen (256 perforations per sq cm) is added. The oil and the bleach mixture are agitated for 20-60 min either by the mechanical agitator, by hand, or by circulating the oil through the pump. Next the oil is pumped manually or automatically to a filter-press. The first batch of oil from the filter-press usually contains remnants of the bleaching clay and is therefore returned to the contact mixer. Subsequent oil from the filter-press (which is clean) is transferred to a separate tank.

NOTE: i. The settling tank can also be utilized as the contact mixing tank.

ii. When a filter-press of the required capacity is not available or when it becomes desirable to increase the capacity of an existing one, oils of low viscosity, such as turbine and transformer oils, may be separated first from the bleaching clay by settling for 6-24 hr, (actual time depends on the viscosity of the oil and the degree of fineness of clay) at 60° C and then fed to the filter-press. In this case, there is a somewhat higher loss of oil.

6. Method No 3, Alkaline Treatment, Catalysis and Filtration (Drawing No 7)

After settling, the waste oil is poured into an alkaline mixer suitable for heating and mechanical or compressed-air agitating. The oil is heated to 90-95° C and treated with a 5-6% aqueous solution of caustic soda, or a 10-20% solution of sodium carbonate. Quantity of alkali added should be approximately three times the amount called for by the saponification number of the waste oil. The oil and alkali mixture is agitated for 15-20 min, then allowed to settle for 2-2.5 hr, after which the alkali and the emulsion are drained off. (Most of the alkali is drained off after 1.5-2 hr, and the remaining alkali and emulsion after another half hour.) The oil is then flushed through and agitated with a volume of boiling water (or better, steam-saturated water) amounting to 30-35% of the oil volume for 15 min. After the oil has settled 40-45 min, the water is drained off.

Flushing, with agitation, is repeated four times, with a 20-min settling period after the second and third flushing, and one hour after the fourth. (Most of the water is drained off in 45 min, the remaining water and emulsion after an additional 15 min.)

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The oil is then dried by heating up to 90-95° C or by the blowing-through of air heated to 80-85° C. The final stage of dehumidification is reached when no water drops or cloudiness appear in the test-tube sample. Finally the dehumidified oil is fed into the mixer for catalytic treatment and subsequently to the filter-press.

7. Method No 4, Acid Treatment, Catalysis and Filtration (Drawing No 8)

The waste oil, after settling and heating to 30-40° C is poured into an air-agitated acid mixer where it is treated twice with commercial-grade sulfuric acid-monohydrate. For preliminary drying of the oil, the first batch of acid is added (0.5-1% of the total) and the mixture air-agitated for 15-20 min; then settling is allowed for about an hour, after which the acid-goudron (the lower acid layer) is drained off.

The second batch of acid is added (3-6% of the total) and the mixture air-agitated for one hour. Then settling takes place for 8-10 hr, followed again by draining off of the acid-goudron. Then this goes to the mixer for catalyzing and, subsequently, to the filter-press.

8. Method No 5, Acid Treatment, Alkaline Treatment, Catalysis and Filtration (Drawing No 9)

The waste oil, after settling, is poured into an acid mixer, where it is treated with sulfuric acid. After draining off the acid-goudron, the oil is transferred to the alkaline mixer, where it is heated to 60-70° C, then neutralized with a 2.5% caustic-soda solution and flushed several times with hot water. Finally it is air-dried, fed into a catalyst mixing tank, and then to the filter-press.

9. Method No 6, Fuel Distillation, Catalysis, and Filtration

This method is employed on:

a. Installations of the "VIME" type (Drawing No 10).

b. Installation of the "Organefi" type (Drawing No 11).

The "VIME" installations are continuous-process systems in which the waste oil is fed into the installation continuously, and the reclaimed oil is continuously discharged.

In the "VIME-2" installation, the waste oil is pump-fed through a filter into a heat exchanger, where it is heated to 40-60° C by fuel vapors passing through a coil. The oil then flows into the coil of the catalyst mixing tank, where it is additionally heated to 120-130° C by hot oil from the evaporator. At this temperature the flowing oil enters the tubular furnace, where it is further heated to 300-325° C (in the case of auto and tractor oils), or to 200-225° C (in the case of aviation oils). The temperature at the furnace exit is regulated by the pressure under which the oil is being pumped, and is maintained within the range of 0.3-3 at. A pressure of over 4 at indicates that the furnace tubes are obstructed, in which case the installation must be stopped and the tubes cleaned.

From the furnace the oil moves into an evaporator, where the fuel content is separated, and from there into the catalyst mixing tank, where it is treated with bleaching clay (5-10% by weight in relation to the weight of the waste oil) at 150-200° C for 15-20 min. Finally it moves on to the filter-press.

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The fuel content is transferred from the evaporator to a fractionating column where the heavy fractions are condensed into a liquid. The light fractions remaining in the vapor state flow through the heat exchanger coils, and upon condensing, are collected in a fuel-receiving tank.

The "Organeft'" installation operates as a batch-process system.

The waste oil is pumped into a heat exchanger, where it is mixed with bleaching clay (3-4% of the weight of the waste oil) during its circulation through the pump for 25-30 min. The oil level in the heat exchanger must not be above three fourths of the exchanger's height. The waste oil in the exchanger is heated to 70-80° C by the hot oil passing through the coil on its way from the electrically heated vat to the catalyst mixing tank.

After the agitating is completed, the oil and clay mixture is transferred by pump or vacuum into a vat where it is heated electrically to 250-280° C. Up to the temperature of 115° C the heating proceeds at the rate of 20-25° C/hr after which the rate is increased to 40-45° C/ . When the electric heating apparatus is connected to the fuel-receiving tank, a vacuum is created, causing the internal pressure in the vat gradually to drop to 60-75 mm Hg. The fuel vapors from the electrically heated vat enter the cooler-condenser, are condensed, and then run into the fuel-receiving tank.

When the final heating temperature is reached and no more liquid fuel is being collected in the fuel receiver, the electric heating apparatus of the vat is switched off. The oil from the vat is then allowed to drain by gravity, through the heat exchanger, into the catalyst mixing tank, from which the oil is pumped back into the vat for a 5-min flushing. Thereupon, it is additionally treated with 3-6% (by weight of the oil) of bleaching clay and circulated through the pump for 25-30 min, and finally run to the filter-press.

10. Method No 7, Acid Treatment, Alkaline Treatment, Fuel Distillation, Catalysis and Filtration (Drawing No 12)

The waste oil, after settling, is directed into the acid mixer to be treated with sulfuric acid. After draining off the acid-goudron the oil goes to the alkaline mixer to be neutralized. The neutralized oil is fed into the fuel-distillation vat, where it is gradually heated to 120° C at the rate of 10-15° C/hr, after which live superheated steam is injected into the vat, and the rate of heating allowed to reach 40-50° C/hr. The volatilized fuel travels through the fractionating column and cooler, and on condensing, is collected in the fuel receiver.

The oil is heated to a temperature of 220-250° C. Then live superheated steam is injected into the oil until there is no more discharge of fuel vapors. From the vat the oil is guided through the cooler into the catalyst agitating tank for the bleaching clay treatment, then on to the filter-press.

Proposed by the Main Administration for Supply of Petroleum Products under the Council of People's Commissars USSR.

Approved by the All-Union Committee on Standards.

Effective 31 August 1943.

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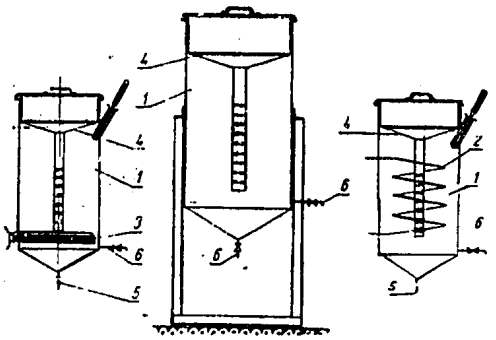
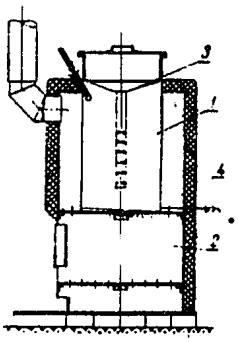


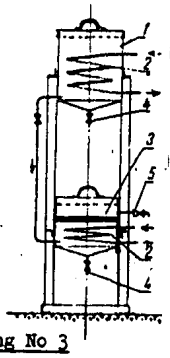
Drawing No 1

1 - Settling tank; 2 - steam coil; 3 - electric heating apparatus; 4 - funnel with screen; 5 - residue drain hole; 6 - oil discharge hole.



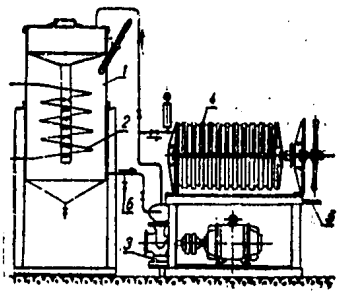
Drawing No 2

1 - Settling tank; 2 - fire chamber; 3 - funnel with screen; 4 - residue drain and oil discharge outlet.



Drawing No 3

1 - Settling tank; 2 - steam coil; 3 - filter; 4 - residue drain outlet; 5 - reclaimed oil discharge outlet.



Drawing No 4

1 - Settling tank; 2 - steam coil; 3 - pump with electric motor; 4 - filter press; 5 - reclaimed oil discharge outlet; 6 - waste oil inlet.

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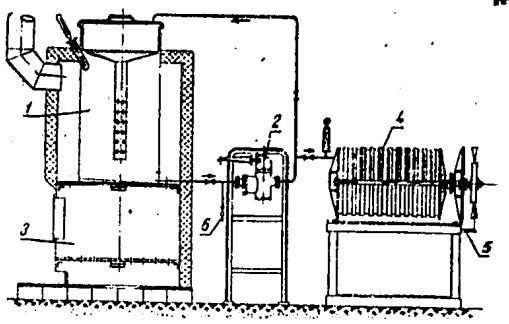
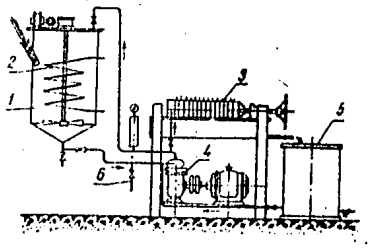


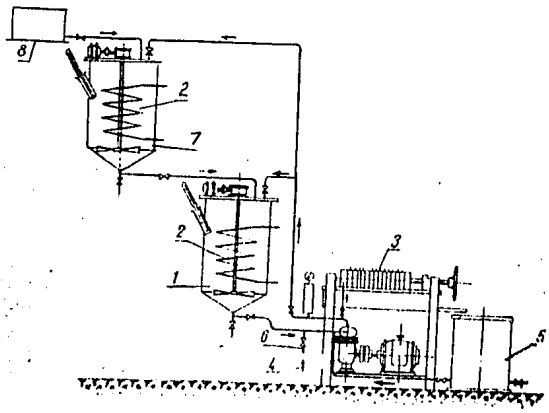
Drawing No 5

1 - Settling tank; 2 - hand pump; 3 - fire chamber; 4 - filter press; 5 - reclaimed oil discharge; 6 - waste oil inlet.



Drawing No 6

1 - Catalyst mixing tank; 2 - steam coil; 3 - filter press; 4 - pump with electric motor; 5 - reclaimed oil vat; 6 - waste oil inlet.



Drawing No 7

1 - Catalyst mixing tank; 2 - steam coil; 3 - filter press; 4 - pump with electric motor; 5 - reclaimed oil vat; 6 - waste oil inlet; 7 - alkali mixing tank; 8 - alkali storage tank.

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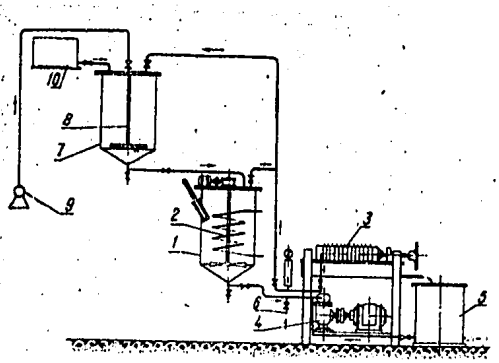
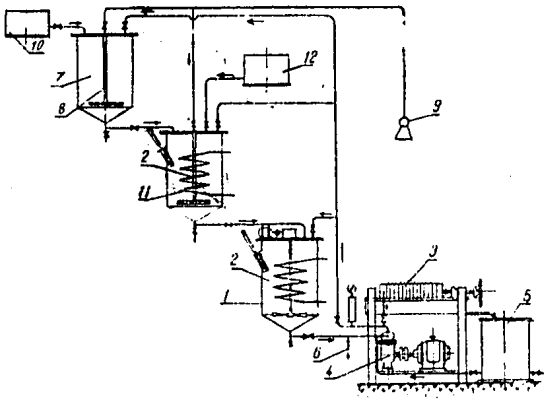


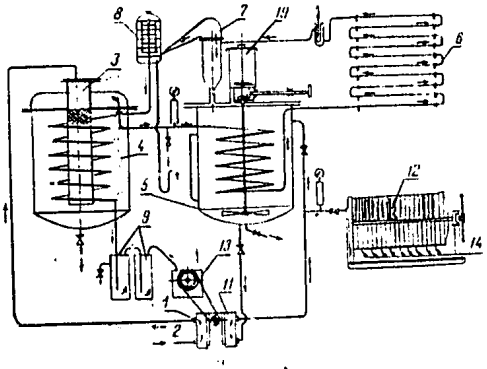
Drawing No 8

1 - Catalyst mixing tank; 2 - steam coil; 3 - filter press; 4 - pump with electric motor; 5 - reclaimed oil vat; 6 - waste oil inlet; 7 - acid mixing tank; 8 - compressed air source; 9 - air blower tube; 10 - acid storage.



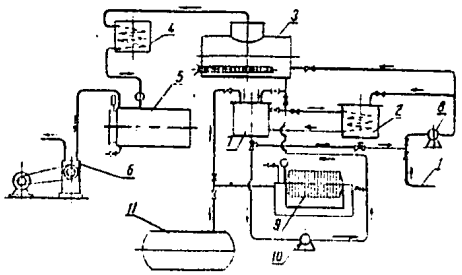
Drawing No 9

1 - Catalyst mixing tank; 2 - steam coil; 3 - filter press; 4 - pump with electric motor; 5 - reclaimed oil vat; 6 - waste oil inlet; 7 - acid mixing tank; 8 - compressed air source; 9 - air blower tube; 10 - acid storage tank; 11 - alkali mixing tank; 12 - alkali storage tank.



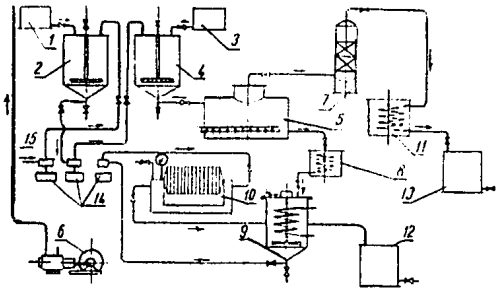
Drawing No 10

1 - Pump; 2 - waste oil inlet; 3 - filter; 4 - heat exchanger; 5 - catalyst mixing tank; 6 - electric furnace; 7 - evaporator; 8 - fractionating column; 9 - fuel receiving tank; 10 - bleaching clay hopper; 11 - pump; 12 - filter press; 13 - vacuum pump; 14 - reclaimed oil discharge.



Drawing No 11

1 - Waste oil inlet; 2 - heat exchanger; 3 - electrically heated vats; 4 - cooler-condenser; 5 - fuel receiving tank; 6 - vacuum pump; 7 - catalyst mixing tank; 8 - pump; 9 - filter press; 10 - pump; 11 - reclaimed oil tank.



Drawing No 12

1 - Acid storage tank; 2 - acid mixing tank; 3 - alkali storage tank; 4 - alkali mixing tank; 5 - fuel distillation vat; 6 - compressor; 7 - fractionating column; 8 - oil cooler; 9 - catalyst mixing tank; 10 - filter press; 11 - fuel vapors cooling chamber; 12 - reclaimed oil tank; 13 - fuel receiving tank; 14 - pump; 15 - waste oil inlet.

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